

CLAIMS

1. A spray device, comprising:

5 a tubular body including an internal surface and first and second open ends, first and second spaced stoppers in said tubular body sealingly engaging said internal surface of said tubular body and moveable within said body, a fluid between
10 said first and second stoppers and a substance between said second stopper and said second open end of said tubular body, said tubular body having a bypass between said second stopper and said second open end, and a spray nozzle on said second open end having a spray port, whereby movement of said first stopper toward said second open
15 end of said tubular body moves said second stopper to adjacent said bypass causing said fluid to flow between said second stopper and said second open end mixing said fluid with said substance, continued movement of said first stopper drives said first stopper against said second stopper, and continued movement of said first stopper drives the mixture of fluid and substance through said spray nozzle, creating a spray
suitable for application to a patient.

2. The spray device as defined in Claim 1, wherein said internal surface of said tubular body has a substantially constant crosssection between said first and second open ends, such that said tubular body may be filled with said fluid and substance from said opposed first and second open ends, thereby reducing
20 crosscontamination between said substance and fluid.

3. The spray device as defined in Claim 1, wherein said spray device includes a third stopper including a body portion and a projecting portion having a diameter less than said body portion receivable in a recess in said spray nozzle.

4. The spray device as defined in Claim 3, wherein said projecting portion of said third stopper is integral with said body portion and said third stopper is formed of a deformable material, such that said projecting portion is axially deformable by an opposed surface of said recess as said first and second stoppers are
5 driven toward said third stopper.

5. The spray device as defined in Claim 3, wherein at least said body portion of said third stopper is initially located in said tubular body portion and spaced from said spray nozzle and movement of said second stopper toward said body portion of said third stopper moves said body portion of said third stopper toward said
10 spray nozzle, establishing fluid communication between said tubular body and a spray nozzle port of said spray nozzle.

6. The spray device as defined in Claim 5, wherein said body portion of said third stopper is separate from said projecting portion and said body portion is initially located in said tubular body and said projecting portion of said third stopper
15 is initially located in said recess in said spray nozzle.

7. The spray device as defined in Claim 1, wherein said spray nozzle includes a spray port and said spray device includes a third stopper between said second stopper and said spray nozzle initially spaced from said spray nozzle, whereby movement of said first and second stoppers moves said third stopper toward said
20 spray port providing space for mixing of said fluid and substance.

8. The spray device as defined in Claim 1, wherein said spray device includes a cup-shaped cap received on said spray nozzle and said cap having a plurality of internal vent passages permitting air to be expelled through said spray port through said internal vent passages.

9. The spray device as defined in Claim 3, wherein said spray nozzle includes a body portion having an internal surface including an internal diameter generally equal to said internal surface of said tubular body and coaxially aligned therewith receiving said body portion of said third stopper, and said internal surface of
5 said body portion of said spray nozzle including a generally longitudinal internal passage providing fluid communication between said tubular body and said spray port when said third stopper is located in said body portion of said spray nozzle.

10. The spray device as defined in Claim 9, wherein said third stopper has a longitudinal length generally equal to the length of said internal surface of said body
10 portion of said spray nozzle, such that said tubular body of said spray device does not communicate with said spray port through said generally longitudinal internal passage until said third stopper is substantially fully located in said body portion of said spray nozzle.

11. The spray device as defined in Claim 10, wherein said longitudinal
15 length of said third stopper is greater than the length of said internal surface of said body portion of said spray nozzle, and said stopper being deformable against an internal surface of said spray nozzle to compress said longitudinal length of said third stopper to provide fluid communication between said tubular body and said spray port through said generally longitudinal internal passage.

20 12. The spray device as defined in Claim 3, wherein said recess in said spray nozzle includes an end wall including said spray port and a groove in said end wall providing fluid communication to said spray port.

13. The spray device as defined in Claim 3, wherein said projecting portion is deformable against an opposed internal surface of said recess of said spray nozzle, whereby movement of said third stopper receives said longitudinal projection in said recess of said spray nozzle, and continued movement of said third stopper
5 compresses said projecting portion and provides fluid communication between said tubular body and said spray port through an internal passage.

14. The spray device as defined in Claim 3, wherein said body portion of said third stopper includes an external diameter sealingly engaging an internal surface of said spray nozzle and said projecting portion of said third stopper being integral
10 with said body portion.

15. The spray device as defined in Claim 3, wherein said third stopper includes a reduced diameter neck portion between said projecting portion and said body portion, and said recess of said spray nozzle including an internal annular rib engaging said projecting portion, whereby axial deformation of said projecting
15 portion receives said rib in said reduced diameter neck portion providing fluid communication between said tubular body and said spray port of said spray nozzle.

16. The spray device as defined in Claim 1, wherein said spray device includes a third stopper having a body portion initially located within said tubular body between said second stopper and said spray nozzle.

17. The spray device as defined in Claim 16, wherein said third stopper includes a separate end portion having a projecting portion receivable within a recess in said spray nozzle, whereby movement of said first and second stoppers toward said spray nozzle moves said body portion of said third stopper to engage said end portion
5 and establish fluid communication between said tubular body and said spray port through a passage in said spray nozzle.

18. The spray device as defined in Claim 17, wherein said body portion of said third stopper includes a passage therethrough and a removable sealing element in said passage, and said end portion of said third stopper including a projecting drive
10 portion extending towards said body portion configured to be received in said passage, whereby movement of said body portion of said third stopper toward said end portion drives said driver portion through said passage, removing said removable sealing element.

19. The spray device as defined in Claim 17, wherein said body portion of
15 said third stopper includes a pierceable septum and said end portion includes a piercing element projecting toward said septum, whereby movement of said body portion toward said end portion drives said piercing element through said septum providing fluid communication through said body portion of said third stopper.

20. A spray device, comprising:

a tubular barrel having an internal surface, opposed first and second open ends and a bypass between said first and second open ends, a spray nozzle member on said second open end of said tubular barrel including an internal surface and a spray port, first, second and third stoppers located within said tubular barrel each having an external surface engaging said internal surface of said tubular barrel and moveable in said tubular barrel, said first stopper initially located adjacent said first open end of said tubular barrel, said second stopper spaced from said first stopper and initially located between said first stopper and said bypass of said tubular barrel and said third stopper having a body portion located between said bypass and said second open end of said tubular barrel, a fluid located between said first and second stoppers and a substance located between said second and third stoppers, whereby movement of said first stopper toward said second open end of said tubular barrel moves said second stopper to adjacent said bypass causing said fluid to flow between said first and second stoppers through said bypass, mixing said fluid between said first and second stoppers with said substance between said second and third stoppers, continued movement of said first stopper then drives said first stopper against said second stopper and continued movement of said first and second stoppers drives said third stopper toward said spray nozzle member to establish fluid communication of the mixture between said second stopper and said third stopper and said spray port creating a spray of said mixture for delivery of said mixture to a patient.

21. The spray device as defined in Claim 20, wherein said internal surface of said spray nozzle member includes a generally longitudinal internal passage providing fluid communication between said tubular barrel and said spray port of said spray nozzle member only when said third stopper is located in said spray nozzle member.

22. The spray device as defined in Claim 20, wherein said third stopper includes a longitudinal projection and said spray nozzle includes a recess coaxially aligned with said spray port configured to receive said longitudinal projection.

23. The spray device as defined in Claim 22, wherein said longitudinal projection is deformable and said longitudinal projection deformed against an internal surface of said recess, whereby movement of said third stopper receives said longitudinal projection in said recess in said spray nozzle member and continued movement of said third stopper axially compresses said longitudinal projection providing fluid communication between said tubular barrel and said spray port through an internal passage.

24. The spray device as defined in Claim 23, wherein said third stopper has a longitudinal length greater than the longitudinal length of said internal surface of said spray nozzle member and said longitudinal projection is compressible, whereby compression of said longitudinal projection drives said third stopper within said spray nozzle member providing fluid communication between said tubular barrel and said spray port through said internal passage.

25. The spray device as defined in Claim 23, wherein said longitudinal projection is deformable and includes a reduced diameter neck portion and said recess includes a radially projecting annular rib adjacent an open end of said recess, whereby movement of said third stopper deforms said longitudinal projection, receiving said
5 internal radial rib into said reduced diameter neck portion establishing fluid communication between said tubular barrel and said spray port of said spray nozzle member.

26. The spray device as defined in Claim 21, wherein said body portion of said third stopper includes an external surface engaging said internal surface of said
10 tubular barrel and a separate end portion including a projecting portion having a diameter less than said body portion of said third stopper received in an opening of said spray nozzle coaxially aligned with said spray port configured to receive said projecting portion, wherein said body portion of said third stopper is initially spaced from said end portion, whereby movement of said body portion of said third stopper
15 into engagement with said end portion receives said body portion in said spray nozzle member establishing fluid communication between said tubular barrel and said spray port through an internal passage.

27. The spray device as defined in Claim 26, wherein said body portion of said third stopper includes a passage therethrough and a movable sealing element in
20 said passage, and said end portion of said third stopper includes a projecting driver portion configured to be received in said passage, whereby movement of said body portion of said third stopper toward said end portion drives said driver portion through said passage, moving said removable sealing member and providing fluid communication through said passage.

28. The spray device as defined in Claim 26, wherein said body portion of said third stopper includes a pierceable septum and said end portion includes a projecting piercing element projecting toward said septum, whereby movement of said body portion of said third stopper toward said end portion drives said projecting
5 piercing element through said septum providing fluid communication through said body portion with said spray port.

29. A method of delivering a fine spray of a medical substance to a patient with a spray device including a tubular barrel having first and second open ends and a bypass spaced between said first and second open ends, a spray nozzle on said second
10 open end having a spray port, first and second stoppers located within said tubular barrel each having an external surface sealingly engaging an internal surface of said tubular barrel and moveable in said tubular barrel, said first stopper initially located adjacent said first open end and said second stopper located between said first stopper and said bypass, a fluid located between said first and second stoppers and a
15 substance located between said second stopper and said second open end of said tubular barrel, said method comprising the following steps:

driving said first stopper toward said second stopper until said second stopper reaches said bypass;

continuing to drive said first stopper toward said second stopper
20 thereby causing said fluid to flow through said bypass and mix with said substance until said first stopper engages said second stopper; and

continuing to drive said first stopper toward said spray nozzle, thereby causing the mixture of fluid and substance to flow through said spray port of said spray nozzle, thereby creating a spray of the mixture of the fluid and substance for
25 application to a patient.

30. The method of delivering a fine spray of medical substance to a patient as defined in Claim 29, wherein said spray device includes a third stopper in said tubular barrel spaced from said spray nozzle, wherein said method further includes driving said first and second stoppers toward said third stopper, thereby causing said
5 third stopper to move toward said spray nozzle thereby providing space for the fluid and substance to intermix.

31. The method of delivering a fine spray of a medical substance to a patient as defined in Claim 30, wherein said third stopper includes a body portion engaging an internal surface of said tubular barrel and a longitudinal projection and
10 said spray nozzle including a recess configured to receive said longitudinal projection, wherein said method includes driving said longitudinal projection of said third stopper into said recess of said spray nozzle.

32. The method of delivering a fine spray of a medical substance to a patient as defined in Claim 31, wherein said longitudinal projection of said third
15 stopper is deformable, said method further including driving said longitudinal projection of said third stopper into said recess and deforming said longitudinal projection.

33. The method of delivering a fine spray of a medical substance to a patient as defined in Claim 31, wherein said spray nozzle includes a tubular body
20 portion having an internal surface and a generally longitudinal passage having a diameter greater than said tubular barrel, wherein said method includes driving said body portion of said third stopper generally into said body portion of said spray nozzle, thereby providing fluid communication between said tubular barrel and said spray nozzle through said passage.